

Concluding Remarks



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LCWS06

- First and foremost: This will be short!
- This set of slides is only because I am incapable of remembering my own name at this stage!
- A set of personal remarks.

- Excellent summaries of Physics discussions provided by the summary speakers this afternoon.
- I will make a few remarks regarding some special features of this LCWS as I see them, and give some perspective of where I think it is going!

Special features of the LCWS:

- Common meeting with the GDE
- The Education and Outreach Workshop for teachers conducted by the Quarknet Group and three Indian Physicists and the Indian Academy of Sciences.
- A meeting between the some members of the Indian Industry who have been involved in making the LHC magnets as well as participated in work related to the detectors, with the Japanese Industry.

The first and the third with a view to seed the process of getting the Indian accelerator community as well as Industry on board the ILC bus!

The third keeping in mind the general need of involving the younger generation!

- Like many others in this audience my love affair with the 'Linear Collider' started 15-20 years ago, when it was called the 'NLC' or the 'JLC' or the 'TESLA', depending on where you were.
- I recall a panel discussion (after the Banquet) in Hawaii, where Bjorn Wiik enunciated the idea of an **International Linear Collider**.
- The process of 'globalisation' is now on, as indicated by the **GOLBAL DESIGN EFFORT(GDE)**.

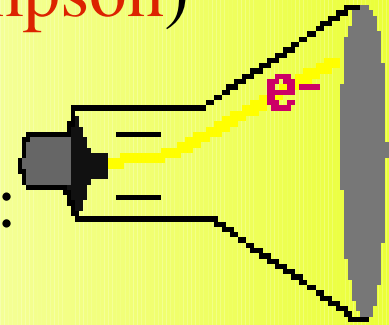
- LCWS had gone global a long time ago, with the WWS committee with regional representations etc.
- Since Paris the special feature had been the **JOINT** discussions between the Accelerator and the Physics (detector and theorists).
- The SLAC LCWS, the first and the second ILC workshops (KEK and Snowmass) carried this idea further.
- The meeting of GDE along with LCWS was the first in this LCWS. There were many discussions in this auditorium which make it clear that we **need even more** of such discussions.

- This very intense and close interaction between the accelerator, detector and physics community is now the hall mark of the future progress of the ILC I feel
- At a personal level: when we looked at the hadronic backgrounds that the beamstrahlung induced two photon processes might cause; some of the accelerator friends started talking to me about '**pinch effects**'.. as a theorist the most I knew was 'pinch singularities' .. so this was my personal realisation that one needed to understand at least a bit of the language of the accelerator friends!
- we need to convince them what we need and why!

The beginning

The **first** elementary particle to be discovered was the electron about 109 years ago (1897: J.J. Thompson)

What was the apparatus: A cathode ray tube:

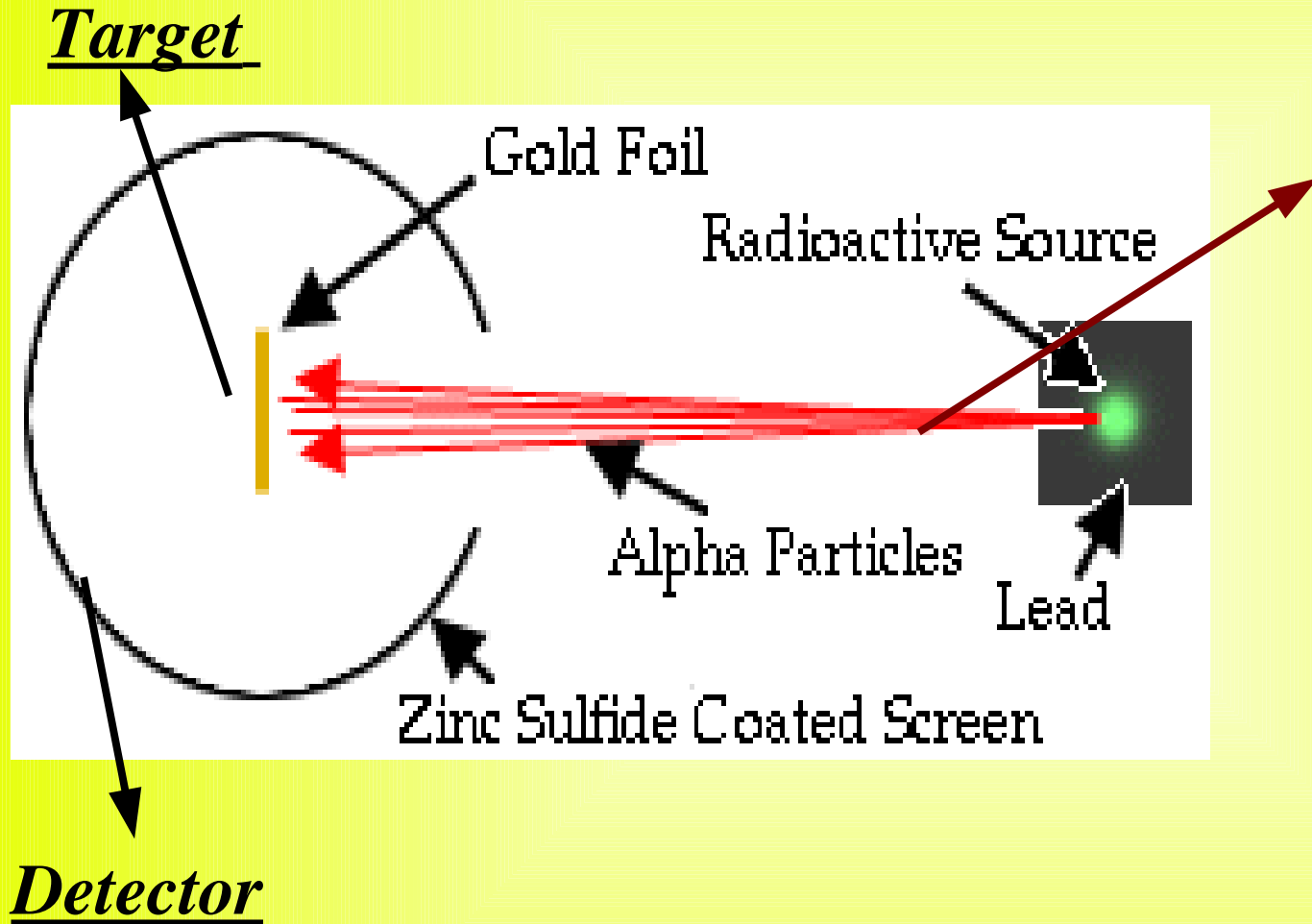


What does a cathode ray tube do? *Accelerate* the electrons emitted by the hot filament, using potential difference.

So this is the classic accelerator used for the discovery of the First *Fundamental* particle the electron.

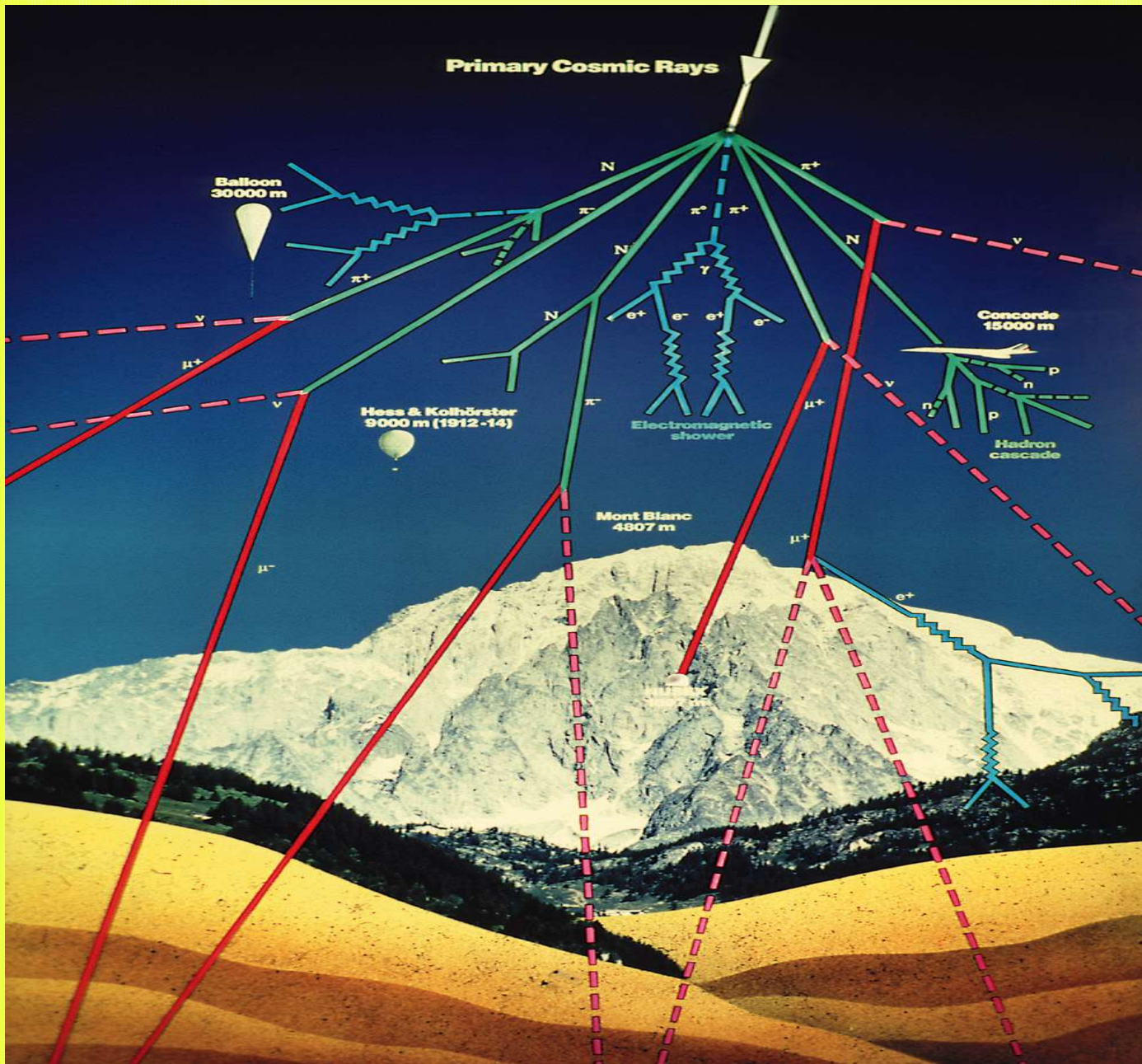
The love affair has never stopped.

First Beams



E. Rutherford

First Accelerators



Synergy between Particle Physics and Accelerators

Beginning from Rutherford, particle physicists wanted always BEAMS with higher and higher energy.

Quotation from Rutherford:

“ It has long been my ambition to have available for studies a copious supply of atoms and electrons which have energies transcending those of the alpha particles from the radioactive bodies ”

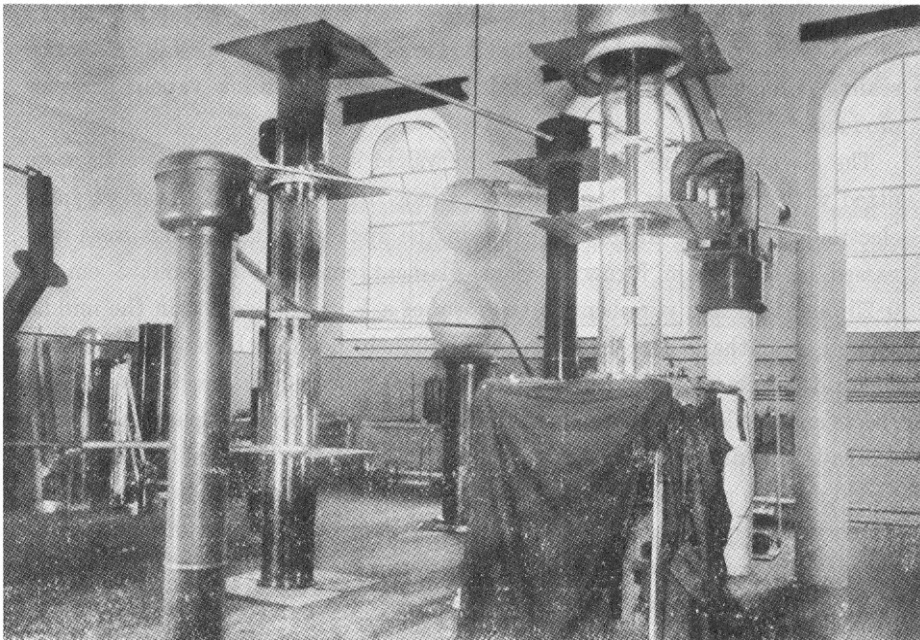
Gamow's work on Barrier penetration proved 0.5 MeV may even be enough for nuclear disintegration.

Note the role played by theoretical developments to set the challenges to accelerator development right from the inception !!

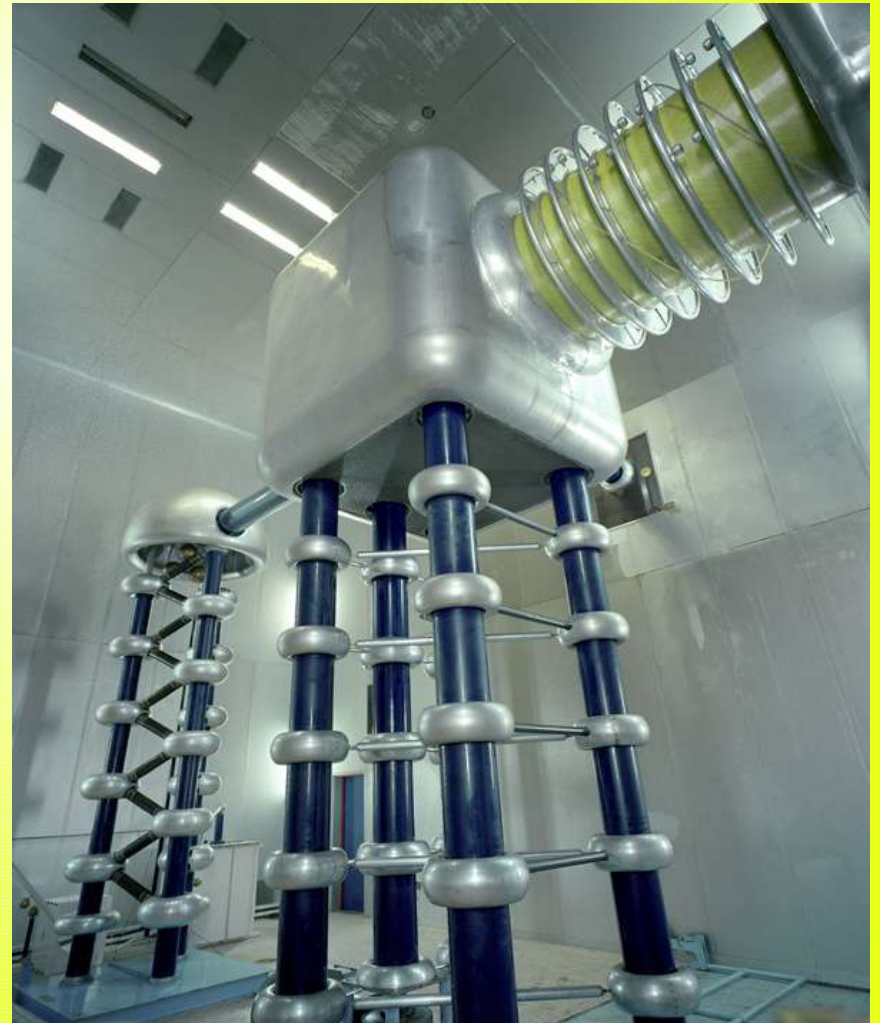
Beginning of artificial acceleration.

The first accelerator accelerated protons to 0.5 MeV and caused artificial disintegration of nuclei in the Cavendish Laboratory.

First one built by W-C

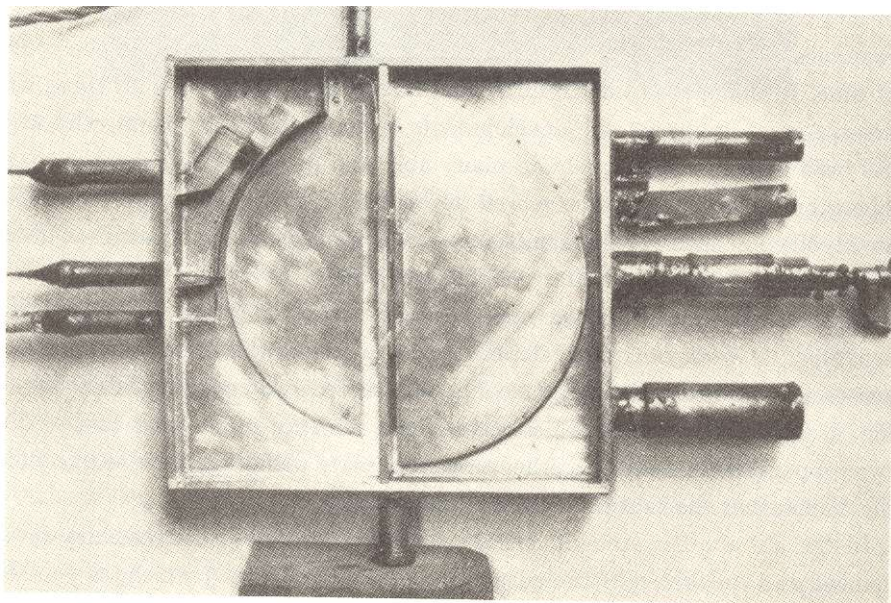


The one in use today in Fermilab



Circular accelerators:

Vacuum chamber of the first cyclotron by Lawrence and Livingston



Cyclotrons , Synchrotrons
Super Proton Synchrtron...

Proton, Anti-proton Collider.

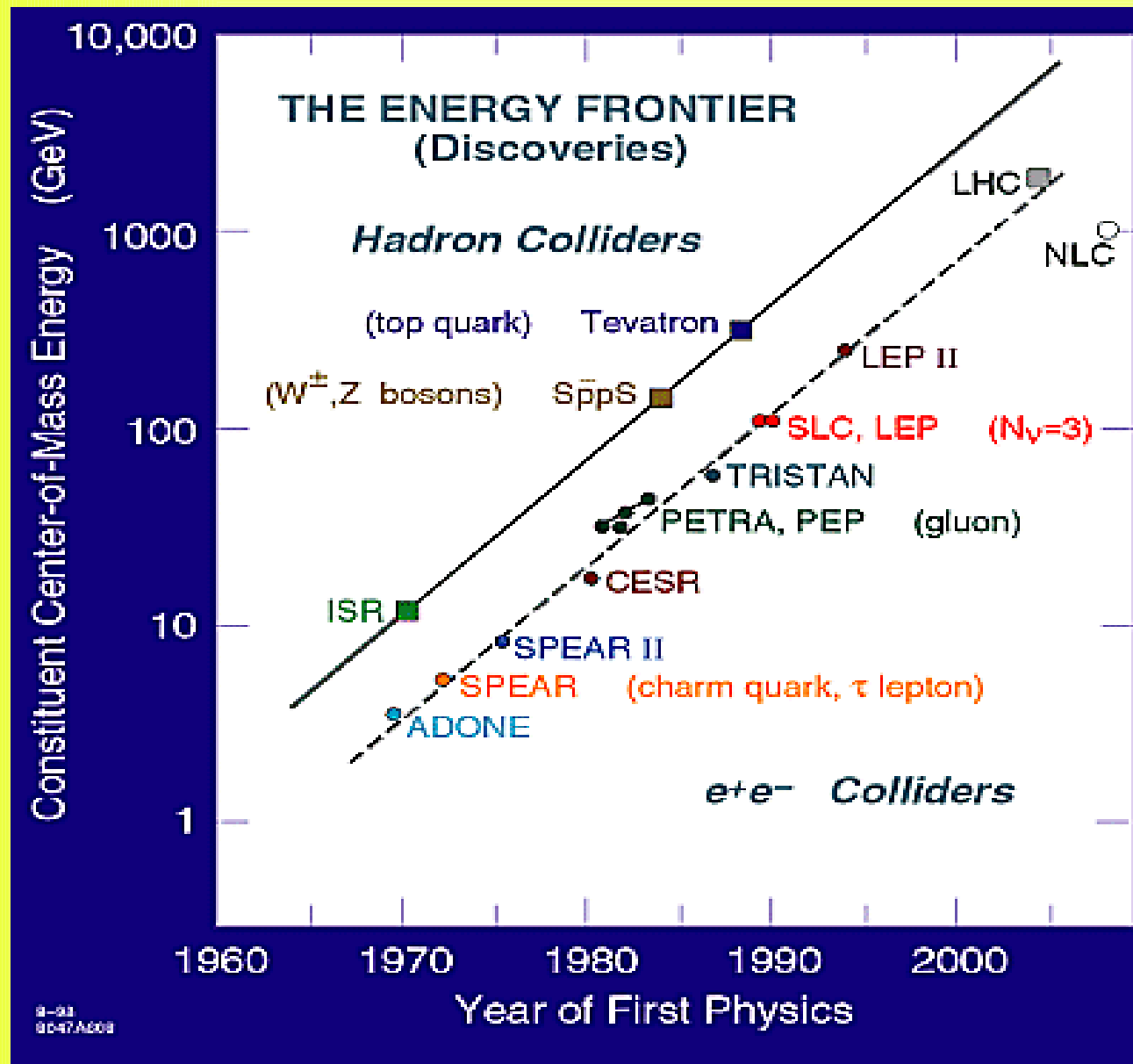


The Tevatron Ring.

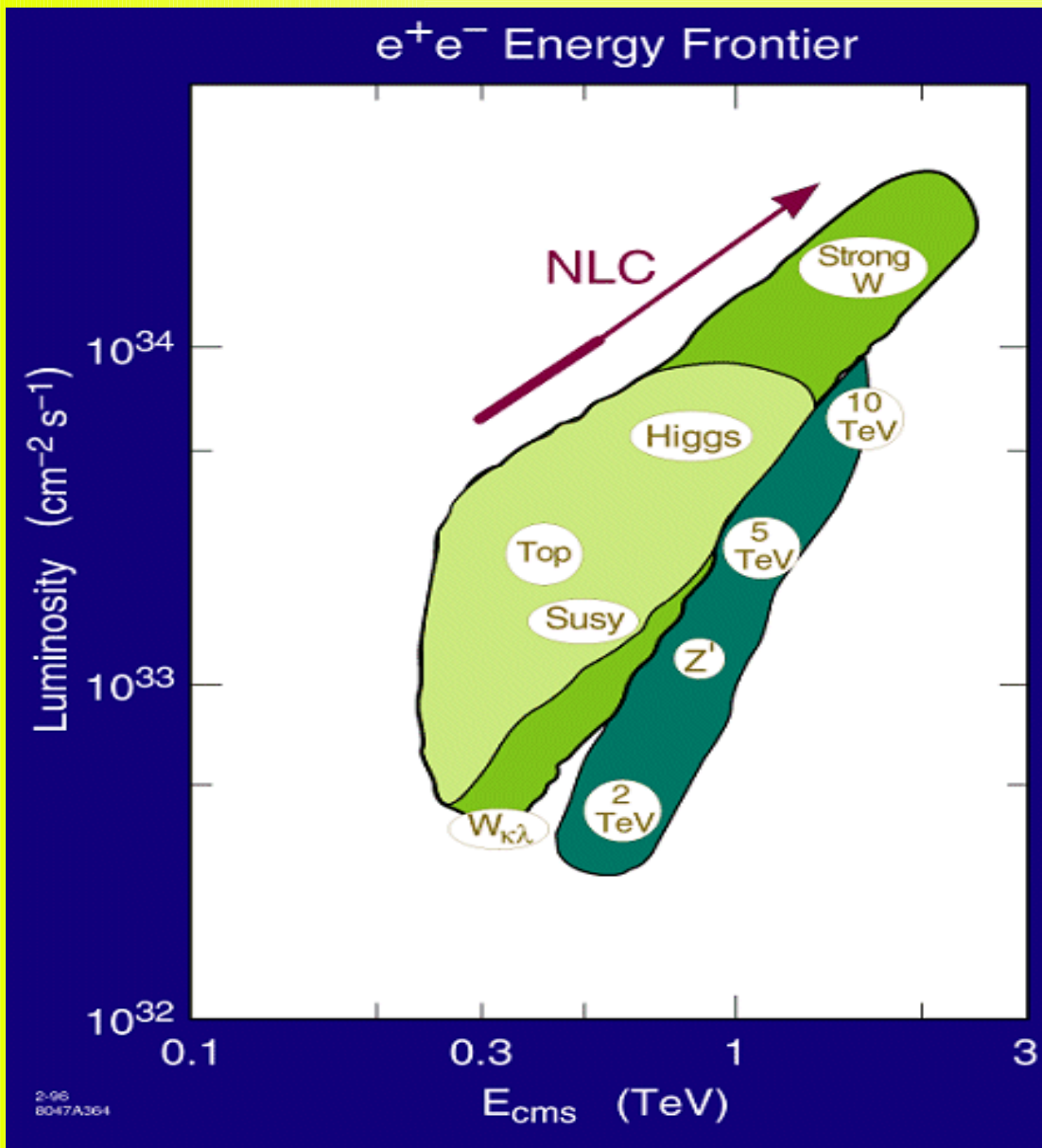
ep collider HERA in Hamburg, DESY.



More modern colliders and the physics they did



FUTURE



I feel we have convinced our accelerator friends about the need of exploring these frontiers,

But we have yet to convince them the need of the two interaction regions AND retaining the possibilities of **options** open.

- This was clear in the discussions in the parallel sessions /plenary sessions of 'one interaction region' versus 'two interaction region'.
- The various panels MDI,BDS... are talking to each other , The discussions, timetables on RDR, Concepts are all on.
- While the RDR contains discussions of two interaction regions, the options seem to be missing!
- In particular the gamma gamma option.

What is clear is that the gamma gamma community would want the GDE to keep in mind the possibility of implementing this option in the future once the ILC comes into existence, while discussing the design options. In the discussions here one did not see any of that!

On the other hand since Jeju there has been going on a transition where the gamma gamma group has been having more and more common sessions with the Higgs group, with the New Physics Group..

At this meeting we had three such common sessions.

The message is that Physics case for the gamma gamma option is getting stronger and stronger

Realistic discussions on gamma gamma technology are on

Plea from the gamma gamma community to the GDE that we need to keep the options possibility open

What is clear is that people (GDE and WWS) are working hard at producing the various reports with the very aggressive dead lines that have been set.

The venue of the next LCWS is still to be announced.. but there will be many many meetings in the meanwhile with/out GDE.

We all need to continue discussing and making sure that while the Cost and Design Board is considering the **Cost of Physics we want to do should also keep in mind the cost to Physics of these decisions!**

Given the enormous amount of effort, thinking going on in the subject and the progress already achieved I fully expect that the **Accelerator and the Physics community** will address this issue effectively and we will achieve the goal of seeing the **BROKEN symmetry!**

